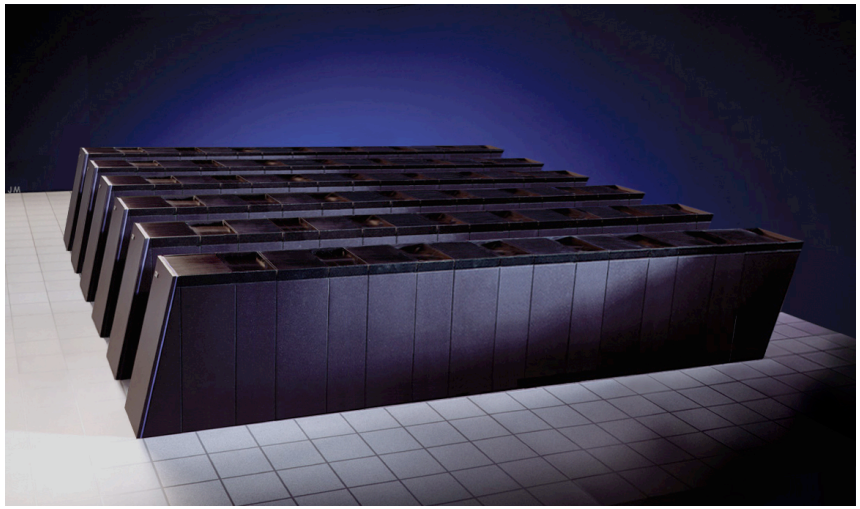
Argonne NATIONAL LABORATORY

Argonne Leadership Computing Facility

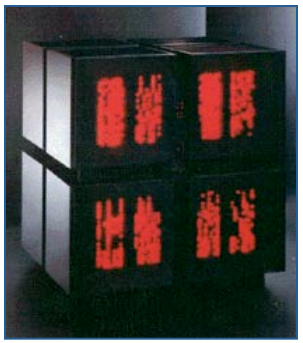
Overview

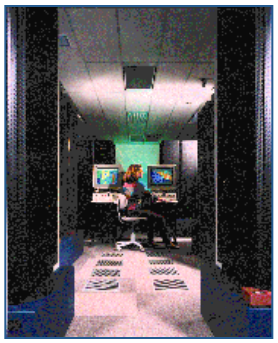


Pete Beckman, Director
Argonne Leadership Computing Facility

Over 20 years of Advanced Systems for DOE and Others

- **ACRF** period [1983-1992]
  - DOE's founding ACRF
  - Explored many parallel architectures, developed programming models and tools, trained >1000 people





- **HPCRC** period [1992-1999]
  - Production-oriented parallel computing for Grand Challenges in addition to Computer Science.
  - Fielded 1st IBM SP in DOE

- **TeraGrid** [2001-present]
  - Overall Project Lead
  - Defining, deploying and operating the integrated national cyberinfrastructure for NSF
  - 9 sites, 22 systems, 200TF

- **LCRC** [2003-present]
  - Lab-wide production supercomputer service
  - All research divisions, 56 projects, 380 users

- **BlueGene Evaluation** [2005-present]
  - Founded BlueGene Consortium with IBM
    - 67 institutions, >260 members
    - Applications Workshop Series
    - Systems Software Collaborations

ALCF Timeline

2004

- Formed of the Blue Gene Consortium with IBM
- DOE-SC selected the ORNL, ANL and PNNL teams for Leadership Computing Facility award

2005

- Installed 5 teraflops Blue Gene/L for evaluation

2006

- Began production support of 6 INCITE projects, with BGW
- Joined IBM and LLNL to design and develop next Blue Genes
- "Lehman" Peer Review of ALCF campaign plans

2007

- Increased to 9 INCITE projects; continued development projects
- Install 100 teraflops Blue Gene/P system

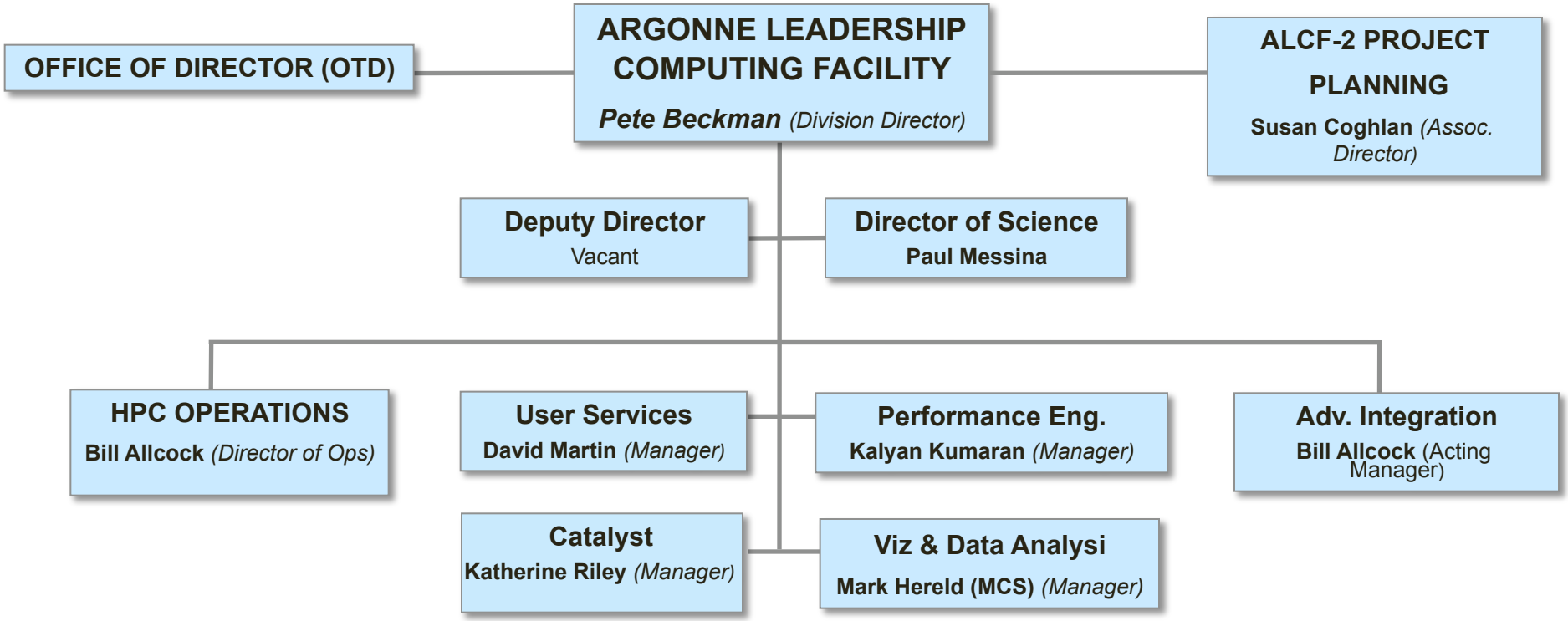
2008

- Began support of 20 INCITE projects on Blue Gene/P
- Add 500T teraflops Blue Gene/P system

2009

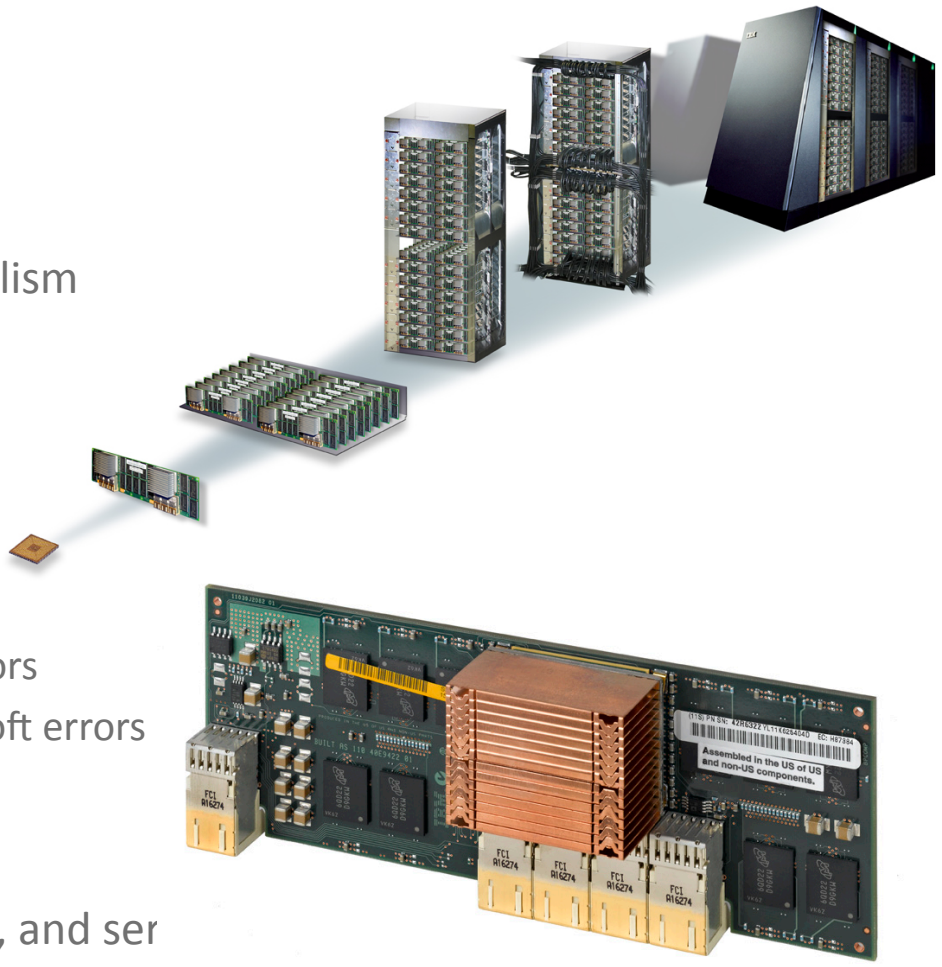
- Went production on 557 teraflops Blue Gene/P system
- Began support of 28 INCITE projects
- Approved for 10 petaflop system to be delivered in 2012 timeframe
- Began joint Argonne/NERSC *Magellan* cloud project
- Delivered 897M core hours to science

ALCF Organization Chart



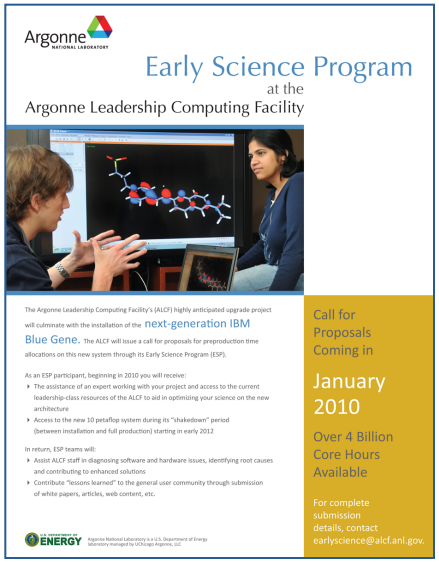
Blue Gene DNA

- Low power design ➡ massive parallelism
  - The leader in Green Computing
- System on a Chip (SoC)
  - Improves Price / Performance
  - Reduces system complexity & power
- Custom designed ASIC
  - Reducing overall part count, reducing errors
  - Permits tweaking CPU design to reduce soft errors
- Dense packaging
- Fast communication network(s)
- Sophisticated RAS (reliability, availability, and ser
- Dynamic software provisioning and configuration



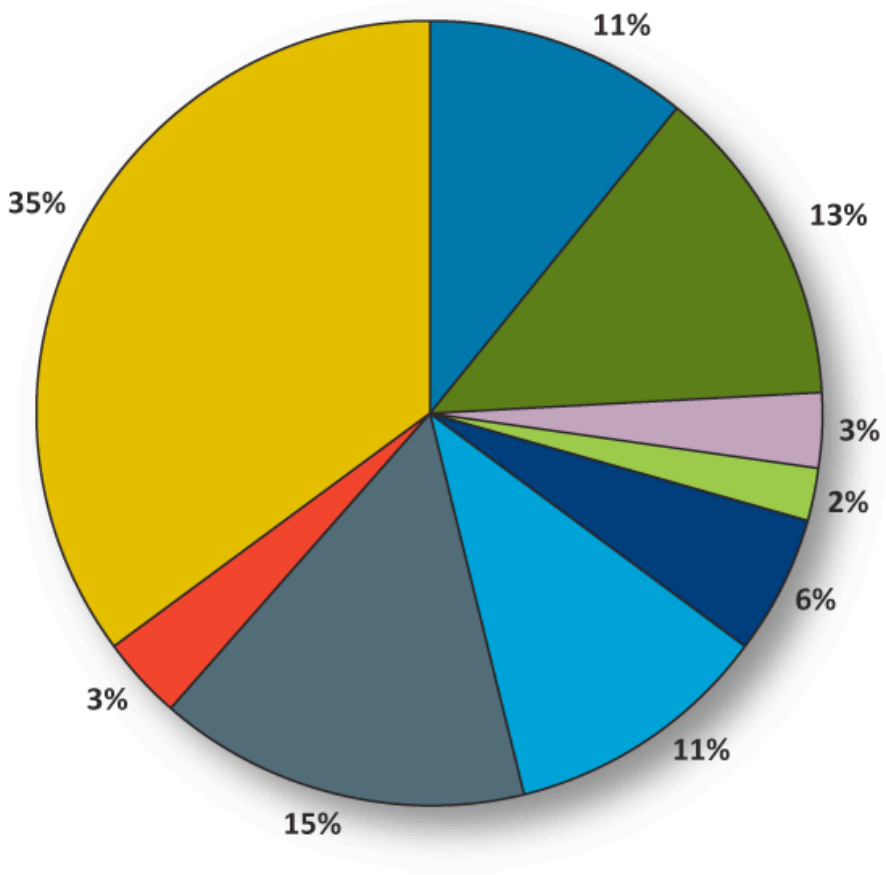
Argonne Theory and Computing Sciences Building

Early Science



- The Argonne Leadership Computing Facility's (ALCF) highly anticipated upgrade project will culminate with the installation of the next-generation IBM Blue Gene. The ALCF will issue a call for proposals for preproduction me allocations on this new system through its Early Science Program (ESP).
- As an ESP participant, beginning in 2010 you will receive:
  - The assistance of an expert working with your project and access to the current leadership-class resources of the ALCF to aid in optimizing your science on the new architecture
  - Access to the new 10 petaflop system during its "shakedown" period (between installation and full production) starting in early 2012
- In return, ESP teams will:
  - Assist ALCF staff in diagnosing software and hardware issues, identifying root causes and contributing to enhanced solutions
  - Contribute "lessons learned" to the general user community through submission of white papers, articles, web content, etc.

2010 INCITE Allocations by Discipline



Total Argonne Hours = 646,000,000

- Astrophysics
- Biological Sciences
- Chemistry
- Computer Science
- Earth Science
- Energy Technologies
- Engineering
- Materials Science
- Physics